MultiDSU56K
Model MT56DSU2

Owner's Manual

MultiDSU56K
Model MT56DSU2
Owner's Manual
P/N 82017502 Rev. C

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Chapter 1 - Introduction and Description

1.1 Introduction

Congratulations! Your new MultiDSU56K is one of the finest DSU/CSUs available today. As a combined CSU (Channel Service Unit) and DSU (Data Service Unit), it provides a direct connection to the DATAPHONE® Digital Service (DDS) network. The MultiDSU56K connects a computer or Data Terminal Equipment (DTE) to remote equipment using DDS network lines at 2400, 4800, 9600, 19200 and 56000 bps speeds for point-to-point and multi-point service.

1.2 About This Manual

This manual contains five chapters and two appendixes. In addition, there is a Glossary and an Index at the end of this manual. The information in this manual is provided as described below.

Chapter 1 - Introduction and Description contains an introduction to the MultiDSU56K product and its features and functions.

Chapter 2 - Hardware Installation provides configuration and installation procedures.

Chapter 3 - Operation describes the functional features and options of the MultiDSU56K.

Chapter 4 - Troubleshooting explains what to do if your MultiDSU56K encounters problems in operation.

Chapter 5 - Service, Warranty and Tech Support defines procedures to follow if the troubleshooting steps in Chapter 4 do not fix the problem.

Appendix A - Applications Examples illustrates several DSU/CSU uses that may help in understanding your particular installation site.

Appendix B - Interface Signals lists the various electronic signals and connector pinouts related to the MultiDSU56K.

Glossary - defines the technical terms used in this manual.

1.3 Description

The MultiDSU56K is compact, easy to operate and has the features to allow flexibility in meeting your transmission requirements. The DDS is a service for transmission of digital signals via digital transmission facilities exclusively. The MultiDSU56K is designed to meet AT&T Technical Publication 62310 requirements. As such, the MultiDSU56K provides all of the functions required on the customer side of the network.

The MultiDSU56K provides user selection of synchronous data communications at rates of 2400, 4800, 9600, 19200 and 56000 bps, and asynchronous data communications rates up to 19200 bps. It provides three separate interface connections (RS232C, V.35 and DDS).

You will find the MultiDSU56K easy to install, use and maintain. It is recommended that you read the entire manual early in your experience with the MultiDSU56K so you can appreciate all of the MultiDSU56K features and options.

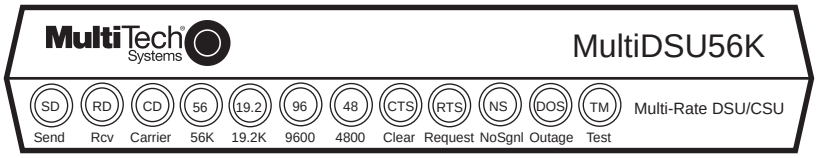


Figure 1-1. Multi-Tech System's MultiDSU56K

1.4 CSU/DSU Basics

A DSU (Data Service Unit) and a CSU (Channel Service Unit) are typically connected to provide the interface between DTE (data terminal equipment) and the DDS (Digital Data Service) or other four-wire network.

The DSU is used to process serial synchronous or asynchronous digital data over the DDS network or other four-wire unloaded twisted-pair wiring network.

The MultiDSU56K can transmit data at 56000, 19200, 9600, 4800 and 2400 bps in multi-point and point-to-point applications.

The MultiDSU56K contains the functions of a Data Service Unit (DSU) and a Channel Service Unit (CSU) in a single package.

1.4.1 DSU Functions

The DSU encodes data as pulses on the communications line by converting the customer data stream to bipolar format for transmission over the digital network.

1.4.2 CSU Functions

The CSU is used to terminate the digital circuit at the customer site. It performs line conditioning functions, ensures network compliance with FCC rules, and responds to test commands (either from the telco central office (CO) or from the CSU).

The figure below shows the MultiDSU56K in a basic DDS network installation.

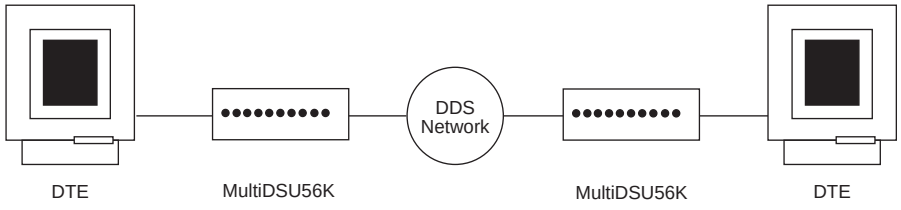


Figure 1-2. Basic DSU/CSU Configuration

1.5 Features

The MultiDSU56K provides many useful features. Standard features include V.35 and RS232 connections and either synchronous or asynchronous transmission; synchronous at rates up to 56000 bps and asynchronous up to 19200 bps; selectable digital rates that match the services offered by the carriers. Other features include user-selectable clocking options, elastic store for analog off-net extensions, anti-streaming, and RTS and DSR signal forced on selection.

Your MultiDSU56K provides the following features:

- supports direct connection to the DATAPHONE Digital Data Service (DDS) or compatible network
- selectable sync speeds of 2400, 4800, 9600, 19200 and 56000 bps
- selectable async speeds of 2400, 4800, 9600, and 19200 bps
- point-to-point and multipoint operation
- Standard RS232C, V.35 and DDS interfaces provided
- anti-streaming (for multi-point operations)
- elastic store (for analog off-net extensions)
- system status
- circuit assurance
- multiple selectable clocking
  * External clocking
  * Internal clocking
  * DDS (slave) clocking
- RTS signal forced on selection
- DSR signal forced on selection
- multiple MultiDSU56K-activated diagnostic tests:
  * Local loopback test
  * Digital loopback test
  * Test pattern generator/detector
- multiple Telco-activated diagnostic tests:
  * DSU loopback test
  * CSU loopback test

1.6 FCC Regulations for Telephone Line Interconnection

1. This equipment complies with Part 68 of the FCC rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN). If requested, this information must be provided to the telephone company.

2. As indicated below, the suitable jack (USOC) connecting arrangement for this equipment is shown in Appendix B. If applicable, the facility interface codes (FIC) and service order codes (SOC) are also indicated.

3. The ringer equivalence number (REN) is used to determine the quantity of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN's should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total REN's, contact the telephone company to determine the maximum REN for the calling area.

4. If this equipment causes harm to the telephone network, the telephone company will notify you in advance. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

5. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.

6. If trouble is experienced with this equipment (the model of which is indicated below) please contact Multi-Tech Systems, Inc. at the address shown below for details of how to have repairs made. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.

7. No repairs are to be made by you. Repairs are to be made only by Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty.

8. This equipment cannot be connected to public coin service provided by the telephone company. (Contact the state public utility commission, public service commission or corporation commission for information.)

Manufacturer:	Multi-Tech Systems, Inc.
Model Number:	MT56DSU2
FCC Pt 68 Registration #:	AU7USA-18883-DE-N
Ringer Equivalence:	N/A
SOC Codes:	6.0N
Modular jack (USOC):	RJ48S
Service Center in U.S.A.:	Multi-Tech Systems, Inc. 2205 Woodale Drive Mounds View, MN 55112 USA (763) 785-3500 or (800) 328-9717 U.S. Fax (763) 785-9874

1.7 Specifications

Model Number	MT56DSU2
Device Operation	combined DSU and CSU
Data Rates	
Synchronous:	2400, 4800, 9600, 19200, 56000 bps
Asynchronous:	2400, 4800, 9600, 19200 bps
Interfaces	
RS232C	DB25S (female)
V.35	34-pos. rectangular (female)
DDS	RJ48 8-position keyed jack
Power Requirements	117V AC, 50-60 Hz, 10 Watts
Temperature	0 to 50 degrees C
Humidity	95% (non-condensing)
Dimensions	1.38" H x 6.15" W x 9" D 3.5 cm H x 15.6 cm W x 22.9 cm D
Weight	2 Lbs. (.9 Kg.) without power transformer 2.7 Lbs. (1.2 Kg.) with power transformer
Certification	FCC Part 15 Class A FCC Part 68 UL Listed
Compatibility	AT&T Pubs 62310 and 41450
FIC Codes	04DU5-24 2.4 Kbps digital interface 04DU5-48 4.8 Kbps digital interface 04DU5-96 9.6 Kbps digital interface 04DU5-19 19.2 Kbps digital interface 04DU5-56 56 Kbps digital interface
USOC Jack	RJ48S
Transmitter/Receiver:	
Modulation	bipolar return to zero
Transmit Level	1.4V peak (+6dBm) into 135 Ohm at 2400, 4800, 19200, and 56000 bps 0.7V peak (0 dBm) into 135 ohm at 9600 bps
Output Impedance	135 ohms
Receive Levels	+6 to -40 dBm at 2400 bps +6 to -40 dBm at 4800 bps 0 to -40 dBm at 9600 bps +6 to -40 dBm at 19200 bps +6 to -45 dBm at 56000 bps
Input Impedance	135 ohms

Delay Times (in secs.):

	RTS/CTS	DCD on	DCD off
2400	8.1	7.5	7.0
4800	4.3	2.6	3.5
9600	2.2	1.6	1.5
19200	1.0	0.8	0.7
56000	0.4	0.3	0.2

Chapter 2 – Hardware Installation

2.1 Introduction

This chapter provides the information needed to configure and install the MultiDSU56K. This manual assumes the reader is familiar with the function and operation of data communications equipment and is technically qualified to provide installation service.

Safety Warning Telecom

1. Never install telephone wiring during a lighting storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. This product is to be used with UL and cUL listed computers.
4. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
5. Use caution when installing or modifying telephone lines.
6. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.
7. Do not use the telephone to report a gas leak in the vicinity of the leak.
8. To reduce the risk of fire, use only No. 26 AWG or larger Telecommunication line Cord.

2.2 Default DIP Switch Settings

The MultiDSU56K printed circuit board contains one 12-position DIP switch block and one 4-position DIP switch block as shown in Figure 2-1. They are located on the side of the circuit board, and are accessible through the side of the chassis. Each individual switch is numbered, and can be in either the up (OPEN) or down (closed) position.

The MultiDSU56K is shipped from the factory with the configuration DIP switches set to the most common settings.

The factory-set (default) settings are: 56K bps data rate, DDS Clocking, RTS Forced On, DSR Forced On, Sync Mode, Loopback Test Disabled, Test Pattern Disabled, Circuit Assurance Disabled, System Status Disabled, 10-Bit Async Word Length, Elastic Store Disabled, and Anti-Streaming Disabled. If you need to change any of these settings, refer to the Changing Defaults sections below.

The Mu11iDSU56K DIP switches are shown and described below.

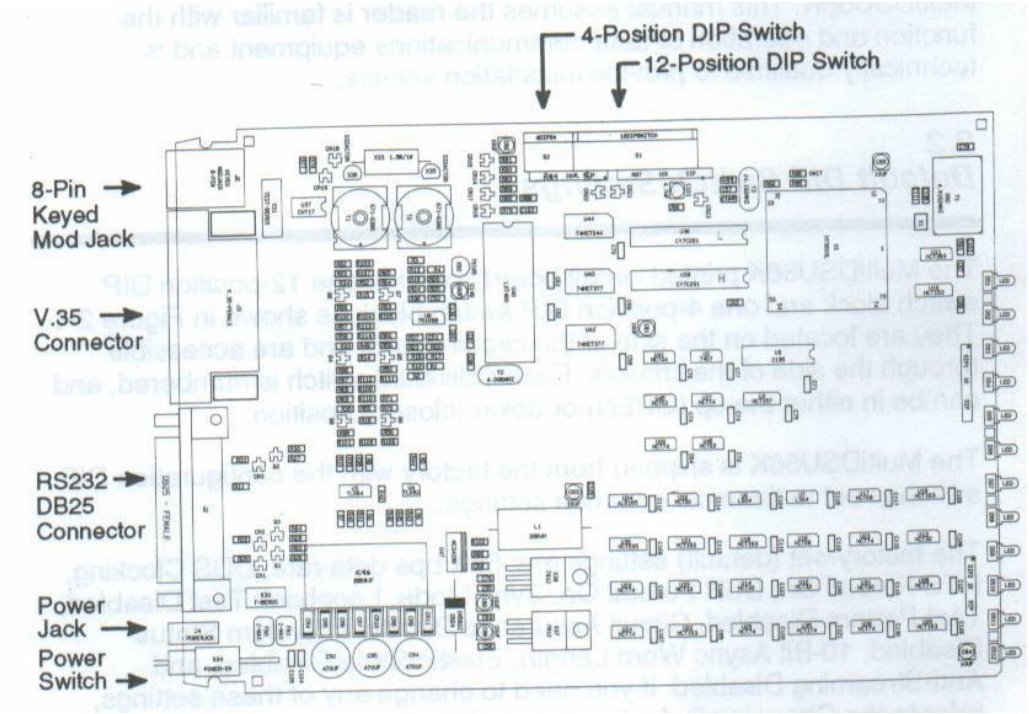


Figure 2-1 MuIttDSU56K Board Layout

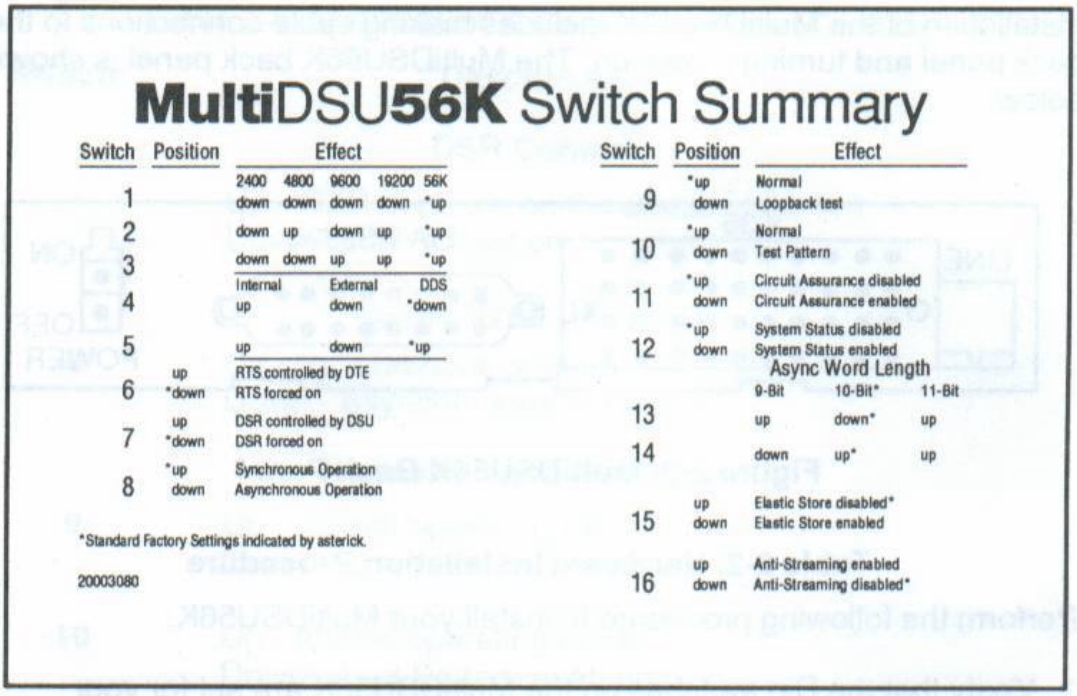
2.2.1 12-Position DIP Switch (#1-12)
The 12-position DIP switch is used to select the data rate, clocking, RTS control, DSR control, AsynclSync operation, diagnostic modes (Loopback Test, Test Pattern), Circuit Assurance, and System Status. The default settings are shown in Table 2-1. If you want to make changes to one of these settings, refer to section 2.3.

2.2.2 4-Position DIP Switch (#13-16)
The 4-position DIP switch is used to select Async Word Length, Elastic Store, and Anti-Streaming options. The defaults are 10-Bit Async Word Length, Elastic Store disabled, and Anti-Streaming disabled. If changes to these settings are required, refer to section 2.3.

2.3 Changing the Default DIP Switch Settings

Use Table 2-1 to determine the DIP switch setting changes required for your MultiDSU56K to operate in your particular environment. You may want to record your switch setting changes for future reference (e.g., troubleshooting, equipment moves/changes, calling Tech Support). The DIP switches are illustrated in Figure 2-1.

An adhesive-backed label containing the DIP switch setting information is provided on the bottom of the MultiDSU56K; a sample label is shown below for reference.



MultiDSU56K Switch Summary

Switch	Position	Effect
1		2400 / 4800 / 9600 / 19200 / 56K down / down / down / down / *up
2		down / up / down / up / *up
3		down / down / up / up / *up
4		Internal: up; External: down; DDS: *down
5		up / down / *up
6	up *down	RTS controlled by DTE RTS forced on
7	up *down	DSR controlled by DSU DSR forced on
8	*up down	Synchronous Operation Asynchronous Operation

*Standard Factory Settings indicated by asterick.

20003080

Switch	Position	Effect
9	*up down	Normal Loopback test
10	*up down	Normal Test Pattern
11	*up down	Circuit Assurance disabled Circuit Assurance enabled
12	*up down	System Status disabled System Status enabled
13		Async Word Length: 9-Bit: up; 10-Bit*: down; 11-Bit: up
14		down / up* / up
15	up down	Elastic Store disabled* Elastic Store enabled
16	up down	Anti-Streaming enabled Anti-Streaming disabled*

The factory default settings are indicated by an * in table 2-1.

Table 2-1. MuII1DSU56K Switch Settings

Switch	Description				
Data Rate (in bps)					
	2400	4800	9600	19.2K	56K
1	Down	Down	Down	Down	Up*****
2	Down	Up	Down	Up	Up*****
3	Down	Down	Up	Up	Up*****
Clocking					
	Internal		External		DDS
4	Up		Down		Down *****
5	Up		Down		Up *****
RTS Control					
6	Up - RTS controlled by DTE Down - RTS forced On *****				
DSR Control					
7	Up – DSR controlled by DTE Down – DSR forced on *****				
Sync / Async Operation					
8	Up – Synchronous operation ***** Down - Asynchronous operation				
Normal / Loopback Test Mode					
9	Up – Normal operation ***** Down – Loopback Test				
Normal / Test Pattern					
10	Up – Normal ***** Down – Test Pattern				
Circuit Assurance Enabled/Disabled					
11	Up – Circuit Assurance Disabled ***** Down - Circuit Assurance Enabled				
System Status Enabled/Disabled					
12	Up - System Status Disabled ***** Down - System Status Enabled				
Async Word Length					
	9-Bit		10-Bit*		11-Bit
13	Up		Down *****		Up
14	Down		Up *		Up
Elastic Store Enabled/Disabled					
15	Up - Elastic Store Disabled ***** Down - Elastic Store Enabled				
Anti-Streaming Enabled/Disabled					
16	Up - Anti-Streaming Enabled Down - Anti-Streaming Disabled *****				

***** Factory default setting

2.4 Installation Procedure

Installation of the MultiDSU56K includes making cable connections to the back panel and turning power on. The MultiDSU56K back panel is shown below.

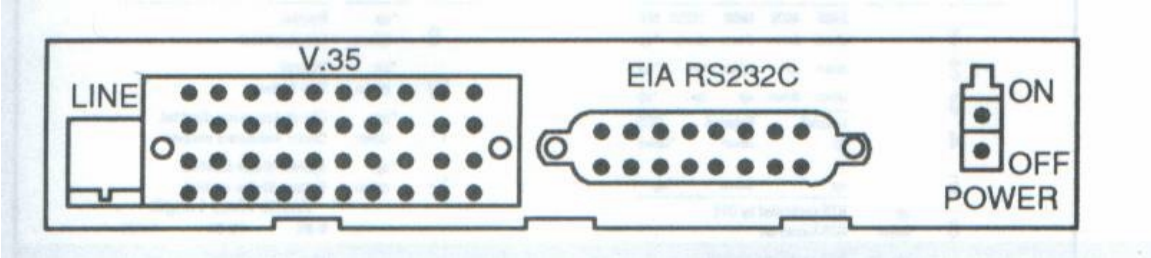


Figure 2-2. MultiDSU56K Back Panel

Perform the steps below to install the MultiDSU56K.

Table 2-2. Hardware Installation Procedure

Perform the following procedure to install your MultiDSU56K.

1. Verify that the Dip switches on the MultiDSU56K are set for your particular configurations; refer to Table 2-1.

2. Connect the appropriate MultiDSU56K back panel DTE interface connector, depending on the DTE:

   • Connect the RS232C connector to the 25-pin DB25S receptacle. Use the two screws to secure the connection, or
   • Connect the 34-position rectangular V.35 connector to the V.35 receptacle.

3. Connect the "LINE" Jack of the MuIt1DSU56K to the DDS receptacle using the line cord provided with the MultiDSU56K.

Note: any cables connected to the computer should be shielded to reduce interference.

4. Connect the other end of the interface cable to the DTEs port connector.
5. Plug in the MultiDSU56K Power Cord into the POWER jack on the MultiDSU56K back panel.
6. Plug the power transformer into an appropriate electrical outlet.
7. Turn the MultiDSU56K POWER switch On. The MultiDSU56K will now operate as described in Chapter 3 of this manual.

Chapter 3 – Operation

3.1 Introduction

This chapter provides information on the operating functions of the MultiDSU56K. During normal operation the MultiDSU56K requires no operator intervention.
Many of the optional features of the MultiDSU56K are selected by setting a DIP switch on the PC board. Please refer to *Changing the Default DIP Switch Settings* (Chapter 2) to change your particular environment.

3.2 Options

The switchable features of the MultiDSU56K are:

- Data Rate
- Async/Sync
- Anti-Streaming
- Elastic Store
- System Status
- Circuit Assurance
- Clocking
- RTS Forced On
- DSR Forced On
- Async Word Length
- NormaL/Diagnostics

The MultiDSU56K has a pre-configured (default) setting for each of these options when shipped from the factory. Refer to Chapters 2 and 4 of this manual for further information regarding these option DIP Switches. The following sections describe the option in terms of the operation of the MultiDSU56K in a DDS or other 4-wire network.

3.2.1 Data Rate

This option allows selection of the MultiDSU56K's data transmission rate. The data rate selected here must match the DDS or other 4-wire network line rate that you subscribed for with your telco.

The default for this function is a data rate of 56K bps. (Refer to Chapter 2 for option switch selection.)

3.2.2 Async/Sync

This option allows selection of the MultiDSU56K's type of data transmission used. The transmission type selected here must match the DTE. The default is "sync" (synchronous data transmission).

3.2.3 Anti-Streaming

This option is typically enabled on remote DSUs using multi-point lines. When enabled, the anti-streaming feature prevents a streaming ("jammed") DTE from affecting communications from remote sites (in a multi-point circuit) that are operating properly.

When Anti-Streaming is enabled, the MultiDSU56K will detect when the DTE device holds RTS (Request To Send) on for longer than *20* seconds. The MultiDSU56K then forces RTS and CTS off internally and sends the DDS Idle Channel signal to the network. The DTE's interface is ignored until the streaming DTE is repaired. The front panel RTS LED is continuously lit and the CTS LED is off when a streaming DTE has been detected.

The default for this function is Anti-Streaming disabled. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.4 Elastic Store

This function allows the MultiDSU56K to compensate for small timing phase "drifts" that occur in applications using analog modems for off-net (non-DDS) extensions. An analog off-net extension application is described in Appendix A. This option should be enabled on all MultiDSU56Ks that are connected to analog modems.

Notes for off-net (elastic store enabled) sites:

- a special DCE-DCE cross-over cable is required (not supplied by Multi-Tech).
- the modem located with the MultiDSU56K must be set for external timing. The modem located at the far end of the off-net extension must be set for slave timing.
- With applications using controlled carrier, the CTS delay of the far-end modem of the off-net extension must be set for a longer period than the MultiDSU56K's CTS delay time.

3.2.5 System Status

With this option enabled, the MultiDSU56K conditions the DSR signal with additional parameters to provide added information to the connected DTE concerning the Ready status of the communications channel.
Normally when this option is enabled, this signal is on when the MultiDSU56K is powered on and not in test mode.

On most modems, the Data Set Ready (DSR) signal at the DIE interface is used to provide a basic indication of the modem actually being ready to transfer data. The System Status option simply provides a better means of informing the DIE of a ready condition.

The default for this function is System Status disabled, preventing the DIE from interpreting momentary line interruptions as a communications channel failure. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.6 Circuit Assurance

This option, when enabled, causes the MultiDSU56K to condition the CTS signal to inform the DIE of the transmit ready status of the entire communications channel.

In most installations, the 015 signal at the DIE interface is the basic P15 signal delayed in time. Even though this could imply that the communications channel is ready for data to be sent, it is not typically conditioned by channel status to indicate an actual "ready" status.

With the Circuit Assurance function enabled, the MultiDSU56K does not turn the 015 signal on unless both the CD is on and the RTS/CTS delay has timed out.

The default for this function is Circuit Assurance disabled. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.7 Clocking

This option allows selection of the MultiDSU56K's clocking (timing for synchronization) from one of three sources. These clocking sources are discussed below.

Internal clocking enables the MultiDSU56K to accept timing from its internal timing oscillator.

External clocking allows the Mu1tiDSU56K to derive timing from any external device that can supply timing to the External Transmit Clock line on the MultiDSU56K's DTE interface connector. This external clock must be within 0.008% of the nominal data rate.

DDS timing allows the MultiDSU56K to accept timing signals from the DDS network's receive bipolar signal. Use this selection whenever the MultiDSU56K is connected to the DDS network lines.

The default for this function is DDS Clocking enabled. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.8 RTS Forced On

With this option enabled, the MultiDSU56K provides a continuous CTS signal, disregarding the state of the RTS signal at the DTE interface connector. This will provide a continuous outbound indication to the network and remote (far-end) device that there is a "Carrier on" condition.
For many (e.g., point-to-point) networks, it is best to maintain a "carrier on" status on the communications channel to help minimize line turnaround delays. This option is usually enabled for central site DSU installations with multipoint lines (i.e., when continuous outbound "carrier on is desired). This option must be disabled on the remote station of a multipoint installation.
When this option is disabled, the MultiDSU56K receives and uses the RTS signal from the DTE.
The default for this function is RTS Forced On. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.9 DSR Forced On

When this option is enabled, the MultiDSU56K forces the DSR signal on continuously regardless of the condition of the received DDS signal (008 or Test). The permanent DSR signal is used to eliminate momentary link interruptions that may be interpreted by the DTE as a communications channel failure. With this option disabled, the DSP is handled as described in the "System Status" section earlier in this chapter.
The default for this function is DSP Forced On. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.1O Async Word Length

This option allows you to select the word length to be used by the MultiDSU56K for asynchronous data transmissions. The Async Word Length selections are 9-, 10- and 11-bits. The async word length selected here must match the async word length set at the DTE.

The default for this function is a 10-bit async word (1 start, 8 data, no parity, 1 stop bit) length. (Refer to Chapter 2 for changing the default DIP switch settings.)

3.2.11 Normal/Diagnostics

The default for this option is "Normal" (standard CSU/DSU operation). For information on the "Diagnostics" selection, refer to Chapter 4.

3.3 LED Indicators

The front panel of the MuIt1DSU56K contains twelve LED indicators that can help in troubleshooting network or device problems. Chapter 4 of this manual contains detailed information on the LED indicators.

3.4 Functions

This section describes the two optional MultiDSU56K modes of operation. The MultiDSU56K can be used as either a point-to-point Local Area Data Set (at speeds up to 56K bps), or in an off-net extension application using conventional analog lines and modems (to complete DDS communications in areas without DDS availability).

3.4.1 Local Area Data Set Applications

Your MultiDSU56K can be used as a point-to-point LADS (Local Area Data Set) at transmission speeds of 2400, 4800, 9600, 19200 or 56000 bps over 4-wire, non-loaded metallic wire pairs.

The MultiDSU56K conforms to the signal power requirements of Bellcore Pub. 41028 (data sets used on LADC), when used at subrate speeds (less than or equal to 19200 bps). The MultiDSU56K does not meet this requirement at the 56K bps rate. The 56K bps rate may be used in applications with customer-supplied lines, or lines not covered by Pub. 41028, or other tariff requirements.

The installation of the MultiDSU56K in a LADS application is the same as for DDS applications, except for the timing (Clocking) setting. LADS applications require one MuIt1DSU56K to be set for Internal timing and the other MuIt1DSU56K to be set for DDS timing (refer to Chapter 2 of this manual). The network cable connection requires "cross-over' wiring, the transmit pair of each MultiDSU56K must be connected to the receive pair of the far-end MultiDSU56K.

The MultiDSU56K uses 4-wire non-loaded metallic circuits for LADS applications. The table below outlines approximations for the maximum cable length for limited distance applications.

	Wire Gage				
Data Rate	19AWG	22AWG	24AWG	26AWG	
2400 bps	22.0	15.0	12.0	9.5	miles
4800bps	19.0	13.0	10.0	8.0	miles
9600 bps	15.0	10.0	7.0	5.5	miles
19200bps	11.9	7.0	5.0	4.0	miles
56000 bps	10.0	6.0	4.2	3.0	miles

Note that line characteristics will vary depending on cable type/manufacturer, splices, bridge taps, etc.

An example of a typical LADS application is shown in Appendix A of this manual.

3.4.2 Off-Net Extension Applications

The MultiDSU56K can be used as an off-net extension with standard analog modems and lines to complete DDS circuits in areas where the DDS is not available or where a customer requirement is for an extension of the circuit for a special application.

In applications using the MuI1iDSU56K for an off-net extension, one Mu1tiDSU56K may be set for External Timing and the other set for DDS Timing; however, in this application, the clock (timing) being supplied must be accurate to *+/- 0.008%* of the enabled data transmission rate.

The Elastic Store option is used in off-net extension applications with analog modems to compensate for small timing phase drifts that typically occur in such applications. A "cross-over" cable is required to connect the MultiDSU56K DTE connector to the analog modem in this application.

The analog modem at the same end as the MultiDSU56K must have External Timing enabled; the modem at the end of the off-net extension must have DDS Timing enabled.

In MultiDSU56K applications that use controlled carrier, the CTS delay for the analog modem at the end of the off-net extension must be longer than the CTS delay of the MuII1DSU56K.

An example of a typical off-net extension application is shown in Appendix A of this manual.

Chapter 4 - Troubleshooting

4.1 Introduction

All of the indicators used in normal operation of the MultiDSU56K are on the front panel. Each front panel LED is labeled, as explained below. The LEDs provide status and maintenance information on the MultiDSU56K, as well as the attached network and line. There are no front panel switches on the MultiDSU56K; refer to Chapter 2 of this manual for option configuration DIP switch settings.

4.2 LED Indicators

The front panel contains twelve LEDs each with a two- or three-letter overlay, and a one-word legend below the LED describing its meaning. During normal operation the LEDs light (flash or continuously lit) to indicate a defined condition. During test mode, the LEDs light during Test Pattern test execution (refer to the Test Pattern section later in this chapter).

The front panel LEDs are shown below.

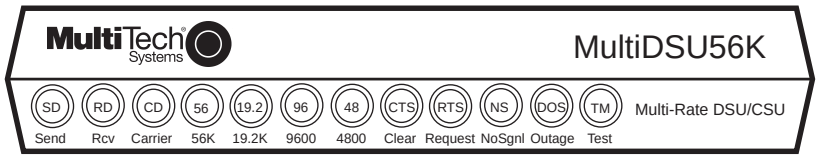


Figure 4-1. MultiDSU56K Front Panel

4.2.1 SD Indicator

The SD (Transmit) LED lights to indicate the DTE is sending data (0 or a space) across the DTE connector.

The SD LED should appear to flash during normal data transmission.

4.2.2 RD Indicator

The RD (Receive) LED lights when the MultiDSU56K receives data (a 0 or a space) from the network.

The RD LED should appear to flash during normal data reception.

4.2.3 CD Indicator

The CD (Carrier Detect) LED lights when the MultiDSU56K has received the data carrier from the network. This indicator will go off when the MultiDSU56K is receiving the idle code or no signal at all. If RTS is off on the remote DSU, the remote DSU sends an idle code to the local DSU.

4.2.4 56K Indicator

The 56K LED lights when the "Data Rate" selection is set at 56000 bps. This indicator will be off for all other data rates. Refer to Chapter 2 for switch settings.

4.2.5 19.2 Indicator

The 19.2 LED lights when the "Data Rate" selection is set at 19200 bps. This indicator will be off for all other data rates. Refer to Chapter 2 for switch settings.

4.2.6 96 Indicator
The 96 LED lights when the "Data Rate" selection is set at 9600 bps. This indicator will be off for all other data rates. Refer to Chapter 2 for switch settings.

4.2.7 48 Indicator
The 48 LED lights when the "Data Rate" selection is set at 4800 bps. This indicator will be off for all other data rates. Refer to Chapter 2 for switch settings.

4.2.8 CTS Indicator
The CTS (Clear to Send) LED lights when the MultiDSU56K generates a CTS in response to either an RTS signal received at the DTE connector, or RTS forced on by the corresponding DIP switch. If the Circuit Assurance option is enabled, the CTS will be off whenever Carrier Detect is off.

4.2.9 RTS Indicator
The RTS LED lights when the RTS signal is received from the DTE. The DIP switch for RTS Forced On does not affect this indicator. Refer to Chapter 2 for switch settings.

4.2.10 NS Indicator
The NS (No Signal) LED lights when no signal at all is received from the network, or when the signal is too weak for normal MultiDSU56K operation. This indicator will also flash to indicate that errors have been detected when using the Test Pattern diagnostic feature.

4.2.11 OOS Indicator
The OOS (Outage) LED lights when an outage condition exists. This occurs when there is a failure in the digital service detected by the network, and the telco sends a repetitive OOS sequence.

If this indicator is on, check the remote DSU for proper installation and operation. If the remote DSU is installed and operating correctly, then report the Out-Of-Service condition to the telephone company.

4.2.12 TM Indicator
The TM (Test Mode) LED lights when one of the Test switches is set to the down (Test enabled) position. When the TM LED is lit, normal operation (network transmit/receive) cannot occur. Refer to the "Diagnostic" Tests section for more information.

4.3 Diagnostic Tests
The MultiDSU56K is set to a default of Normal (non-diagnostic) mode at the factory. When diagnostics are to be run, change the DIP switches as described in Chapter 2 of this manual.

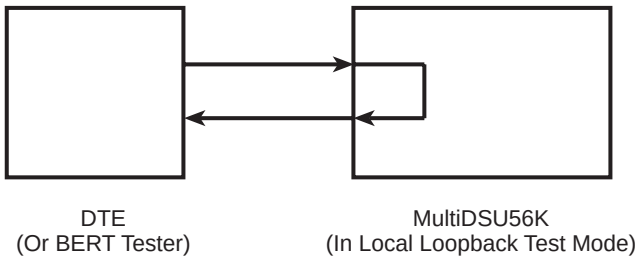
When a failure occurs in the digital facility (telco equipment), the network will detect the failure and send a repetitive OOS signal sequence to your equipment. Your equipment can detect local loop failure by the absence or distortion of the digital signal. If an OOS is received when data is expected, check the remote (far-end) transmitting equipment. If the remote equipment is transmitting properly, contact your telephone company. If the telco is required to perform remote tests, the channel will be temporarily interrupted and loss of data may occur.

The following sections describe the tests that are available for the MultiDSU56K.

4.3.1 Local Loopback Test

This test allows you to test the local DTE and the local MultiDSU56K. Use the following steps to perform the Local Loopback Test.

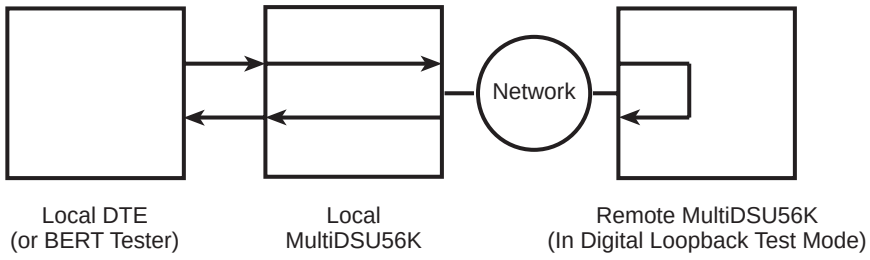
1. Set DIP switch #9 to the down position.
2. The front panel Test (TM) LED lights, and if you send data from your DTE, it should be "looped back" to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.



4.3.2 Digital Loopback Test

This test allows you to test the local DTE, the local MultiDSU56K, the communications link, and the remote MultiDSU56K. Use the following steps to perform the Digital Loopback Test.

1. Set DIP switch #9 on the remote MultiDSU56K to the down position.
2. The front panel Test (TM) LED lights, and if you send data from the local DTE, it should be looped back to the local DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the local DTE.

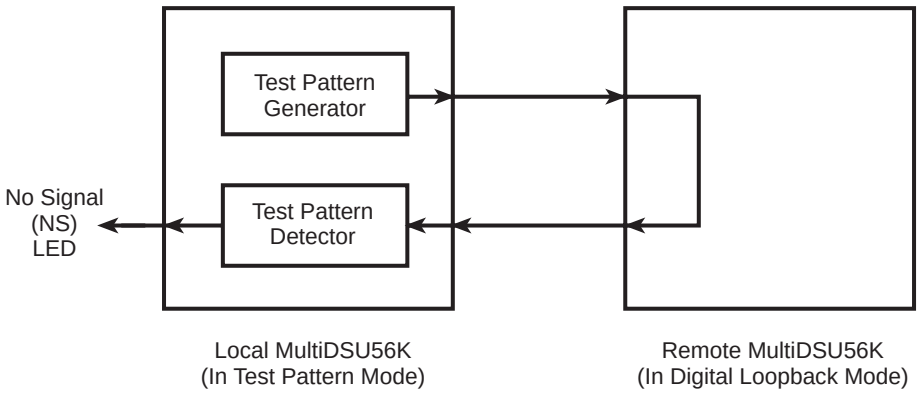


4.3.3 Digital Loopback Test With Test Pattern Test

This test allows you to test the local MultiDSU56K, the communications link, and the remote MultiDSU56K. Use the following steps to perform the Digital Loopback Test with the Pattern Test.

With this test enabled, the MultiDSU56K sends and detects a pre-defined 15-bit pseudo-random test pattern. When an error is detected by the MultiDSU56K, the NS (No Signal) LED flashes.

1. Set DIP switch #9 on the remote MultiDSU56K to the down position.
2. Set DIP switch #10 on the local MultiDSU56K to the down position.
3. The test pattern is generated and either detected as a good test pattern (test patterns match) or as a failed test (test pattern received does not match the pattern sent).

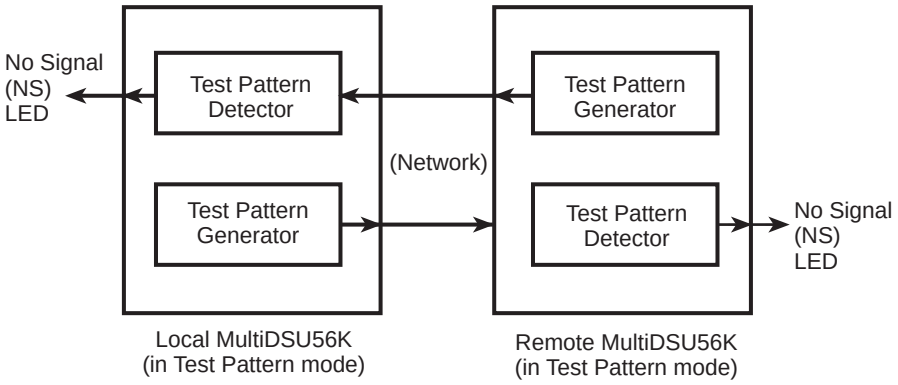

Test Pattern Generator
Test Pattern Detector
No Signal (NS) LED
Local MultiDSU56K (In Test Pattern Mode)
Remote MultiDSU56K (In Digital Loopback Mode)

4.3.4 Test Pattern Test

This test allows you to test the local MultiDSU56K, the communications link, and the remote MultiDSU56K.

With this test enabled, the MultiDSU56K sends and detects a pre-defined 15-bit pseudo-random test pattern. When an error is detected by the MultiDSU56K, the NS (No Signal) LED flashes. To enable the Test Pattern Test, perform the following.

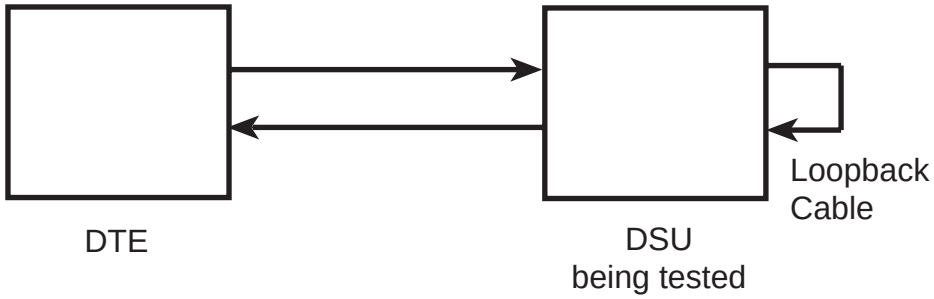
1. Set DIP switch #10 on both the local and the remote MultiDSU56K to the down position.
2. The test pattern is generated and either detected as a good test pattern (test patterns match) or as a failed test (test pattern received does not match the pattern sent).



4.3.5 DSU Loopback Test

This test lets you verify proper DSU operation by matching a transmitted signal to the "looped-back" receive signal. Refer to Appendix B for cable description.

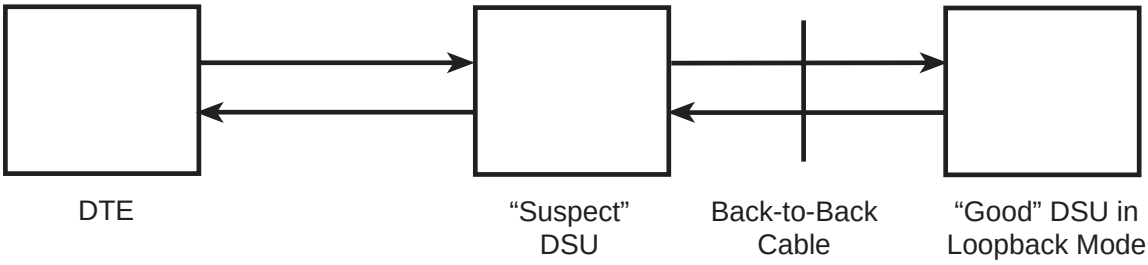
1. Obtain a DSU Loopback cable (#45640100) from Multi-Tech, or assemble one. Refer to Appendix B for instructions on building the Loopback cable.
2. Plug the Loopback cable into the back panel LINE jack.
3. If you send data from your DTE, it should be "looped back" to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.



4.3.6 DSU Back-to-Back Test

This test lets you connect two DSUs with a back-to-back cable to verify proper DSU operation. Using a DSU that is known to be operational, you can test a second DSU that is suspect.

1. Obtain a DSU Back-to-Back cable (#45050000) from Multi-Tech, or assemble one. Refer to Appendix B for instructions on building the Back-to-Back cable.
2. Plug the cable into each DSU's LINE jack.
3. On the "good" DSU, set DIP switch #9 to the down position.
4. Set one DSU to internal clocking and the other DSU to DDS clocking.
5. If you send data from your DTE, it should be "looped back" to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.



Chapter 5 – Service, Warranty and Tech Support

Limited Warranty

Multi-Tech Systems, Inc. *(icMTS*l,) warrants that its products will be free from defects in material or workmanship for a period of two years from the date of purchase, or if proof of purchase is not provided, two years from date of shipment. MTS MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by the customer or any party without MTS™s written authorization, or used in any manner inconsistent with MTS™s instructions. MTS™s entire obligation under this warranty shall be limited (at MTS™s option) to repair or replacement of any products which prove to be defective within the warranty period, or, at MTS™s option, issuance of a refund of the purchase price. Defective products must
be returned by Customer to MTS™s factory transportation prepaid.
MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES AND UNDER NO IRCUMSTANCES WILL ITS LIABILITY EXCEED THE PURCHASE PRICE FOR DEFECTIVE PRODUCTS.

On-line Warranty Registration

To register your DSU on-line, go to: http://www.multitech.com/register

Tech Support

Multi-Tech has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, call 1-800-972-2439. Please fill out the modem information (below), and have it available when you call. If your DSU requires service, the tech support specialist will guide you on how to send in your DSU.

4.2.1 Recording Product Information

Please fill in the following information on your Multi-Tech product. This will help Tech Support in answering your questions.

Model No.: _____
Serial No.: _____

The model and serial numbers are silkscreened on the bottom of your DSU.
Please note the status of your DSU before calling tech support. This status can include LED indicators, screen messages, diagnostic test results, problems with a specific application, etc.

Service

If your tech support specialist decides that service is required, DSUs may be sent (freight prepaid) to our factory. Return shipping charges will be paid by Multi-Tech Systems (within North America).
Include the following with your modem:

- a description of the problem.
- return billing and return shipping addresses.
- contact name and phone number.
- check or purchase order number for payment if the modem is out of warranty. (The standard repair charge for this modem is $95. This price is valid at the time of this publication but could change in the future. Check with your technical support specialist.)
- if possible, note the name of the technical support specialist with whom you spoke.

If you need to inquire about the status of the returned product, be prepared to provide the **serial number** of the product sent .

Send DSUs to:

MULTI-TECH SYSTEMS, INC.
2205 WOODALE DRIVE
MOUNDS VIEW, MINNESOTA 55112
ATTN: SERVICE OR REPAIRS

Appendix A - Application Examples

INTRODUCTION

This section illustrates several types of applications in which the MultiDSU56K is typically used . These types include:

• DDS point-to-point application,
• DDS multipoint (polled) application,
• Local Area Data Set,
• External Clocking application, and
• Analog Off-Net Extension application

DDS POINT-TO-POINT APPLICATION

In this application, the MultiDSU56K provides the interface between the DDS line and the DTE at your site. Your network provider will provide (at your request) a DDS line connecting the desired locations.

The figure below depicts a sample DDS Point-to-point application.

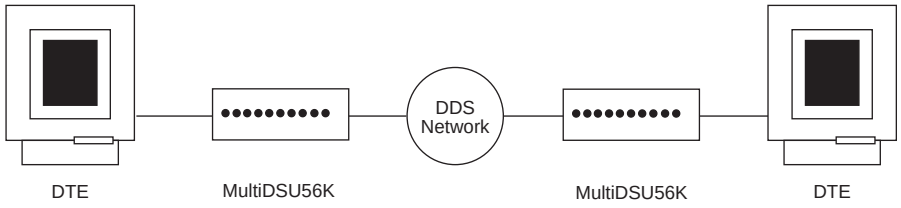


Figure A-1. DDS Point-to-Point Application

DDS MULTIPOINT (POLLED) APPLICATION

Since your Central Office (CO) equipment must include "Multipoint Junction Units" (MJU5) and other special arrangements for this type of service, you may need to coordinate efforts with your network service provider.
The MultiDSU56K at the host end is the Master Station (also called the "Control Station"), which typically has RTS forced on. The attached MultiDSU56Ks are called "remote stations" and have RTS controlled by the DTE.
Multipoint DDS provides communication between a control station and two or more remote stations. All data transmitted by the control station is sent to each remote station. For data transmitted from the remote stations, the MJUs combine bit streams from the remote stations into a single, serial bit stream sent to the control station. All stations on the same multipoint circuit must run at the same bit rate (any of the DDS customer service rates).
The figure below shows a typical Multipoint (Polled) application.

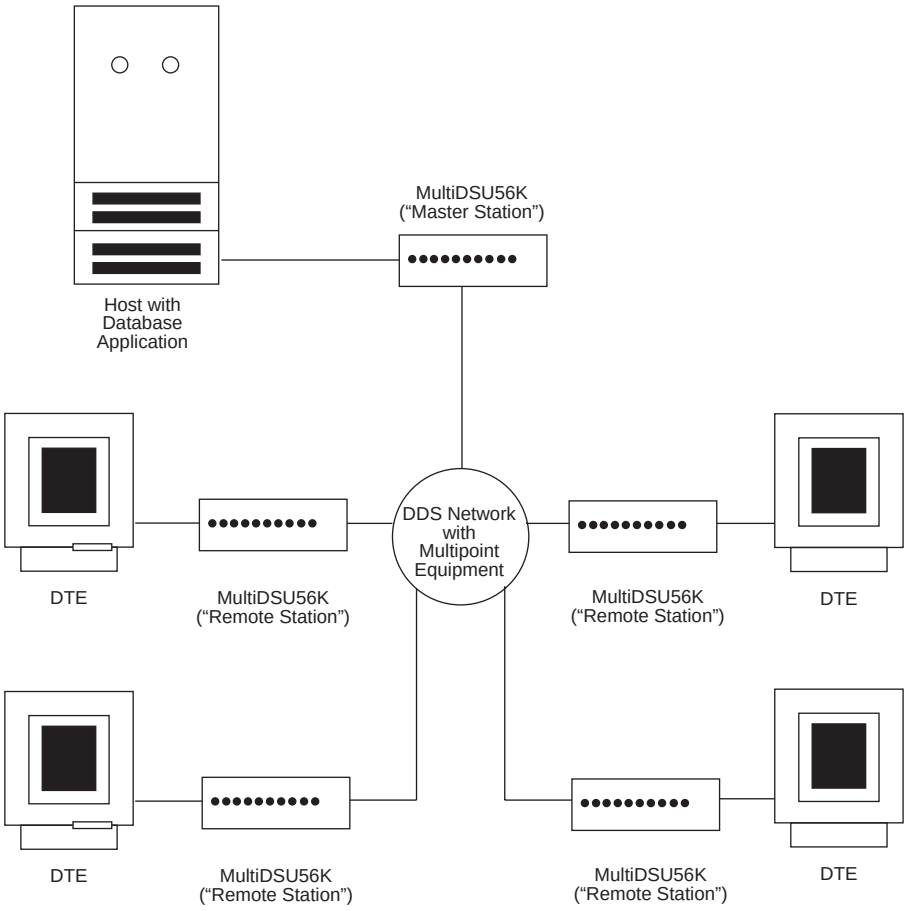


Figure A-2. DDS Multipoint Polled Application

LOCAL AREA DATA SET APPLICATION

In this application, two pairs of wires provide the connection between two MultiDSU56K devices. The two pairs can be up to the equivalent of 3 miles of 26 AWG wire at 56000 bps, or longer for subrate applications (see distances chart in section 3.4.1 of this manual).
The figure below depicts a typical Local Area Data Set application.

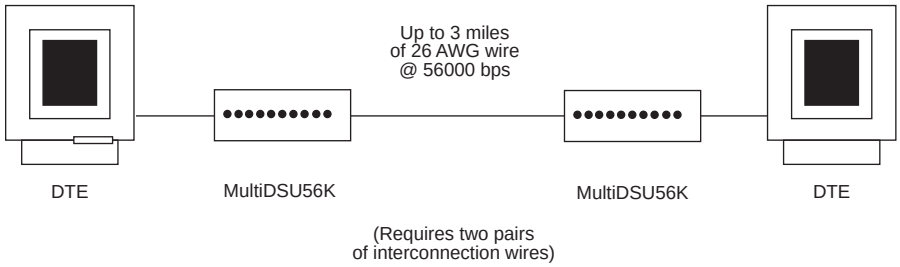


Figure A-3. Local Area Data Set Application

EXTERNAL CLOCKING APPLICATION

This application is similar to the Local Area Data Set application except for the timing option setting. In the example below, the DTE connector of the T1 mux is connected to the DTE connector of the MultiDSU56K. Here, the MultiDSU56K must receive timing information from the T1 mux.
The MultiDSU56K is set for external timing in this type of application. At the DTE end, DDS timing is selected, providing normal clocking to the DTE.

The figure below shows a typical External Clocking application.

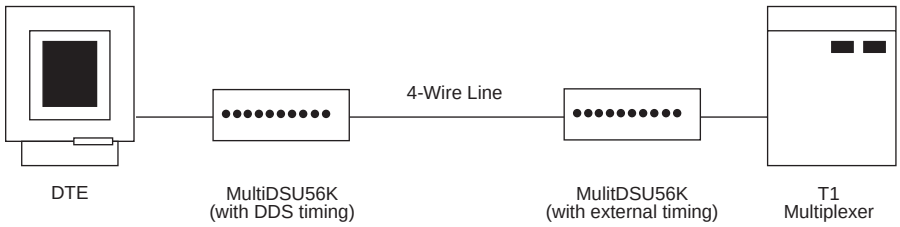


Figure A-4. External Clocking Application

ANALOG OFF-NET EXTENSION APPLICATION

In this application, the MultiDSU56K is used with conventional analog modems and lines to complete DDS circuits in an area where DDS is not available (Site #3 in the example below) or where the customer requires an extension of the DDS circuit for a special application.

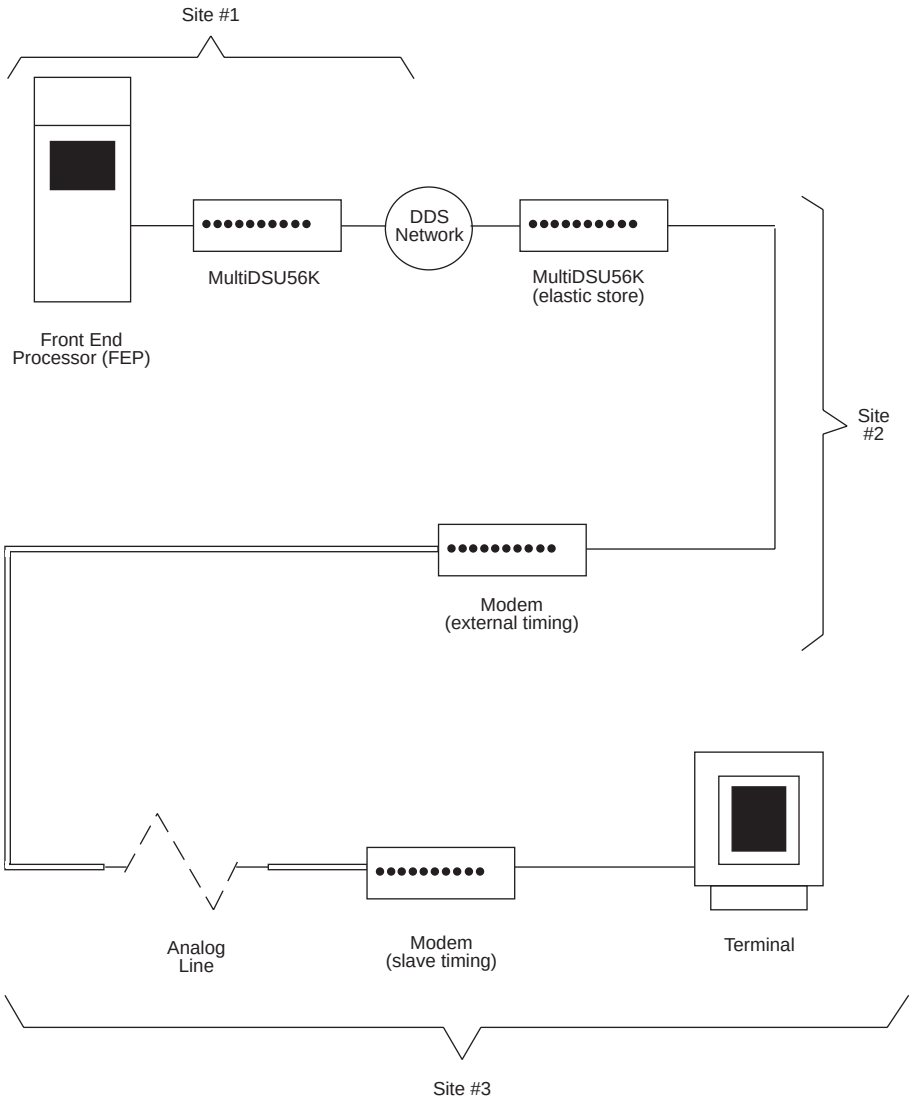
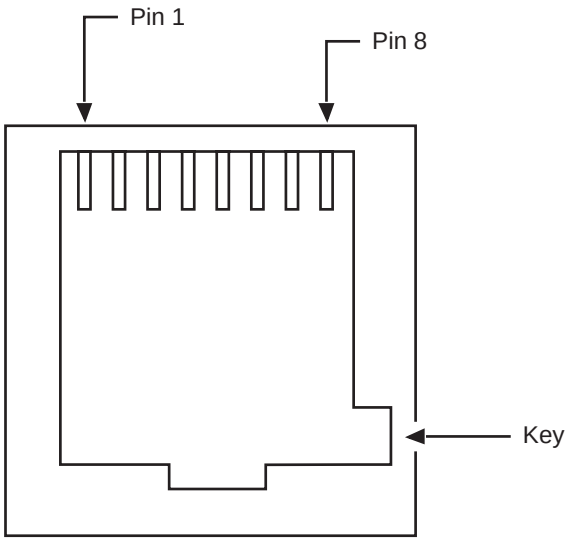


Figure A-5. Analog Off-Net Extension Application

Appendix B - Interface Signals and Connector Pinouts

DDS RJ48 CONNECTOR



As viewed from the rear

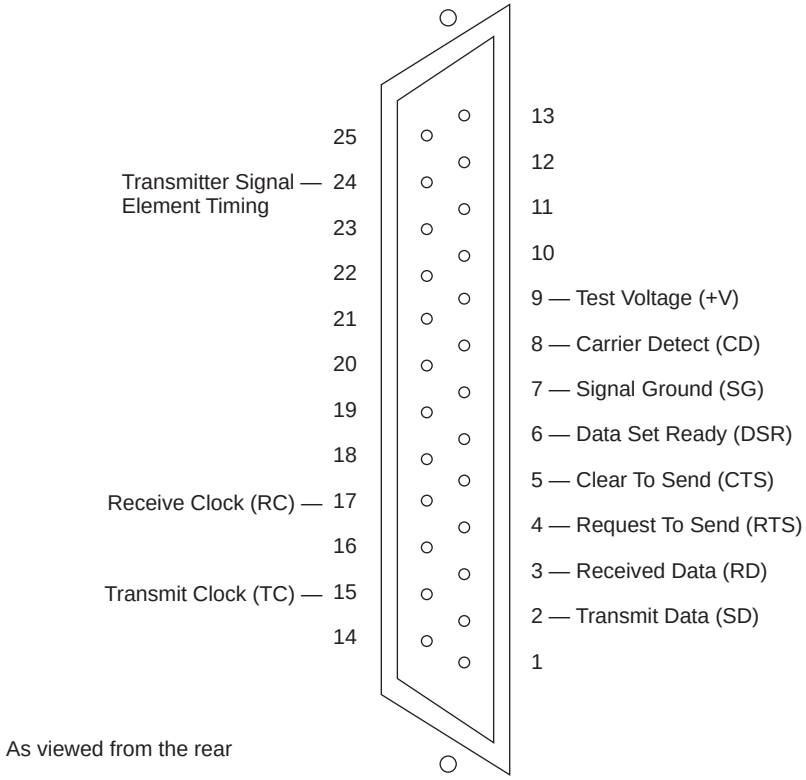
DESCRIPTION

This connector ties the MultiDSU56K to the DDS Network. The RJ48 connector is keyed for proper insertion of a keyed RJ48 plug.

PIN IDENTIFICATION

Pin	Description	Destination
1	Transmit Pair	To Line
2	Transmit pair	To Line
3	N/C	
4	N/C	
5	N/C	
6	N/C	
7	Receive Pair	From Line
8	Receive Pair	From Line

RS232C DB25S CONNECTOR



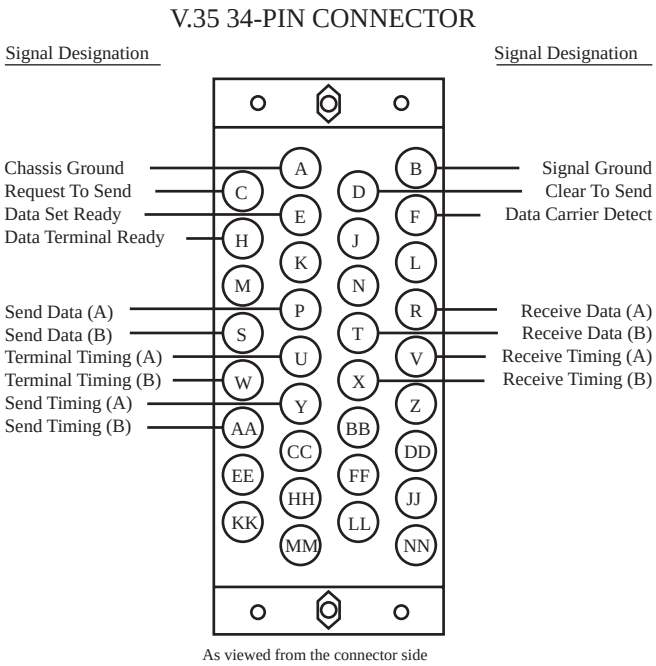
DESCRIPTION

This connector ties the MultiDSU56K to the DTE. The DB25S connector has the following pinout configuration.

PIN IDENTIFICATION

Pin	Description	Signal
2	Transmit Data	SD
3	Received Data	RD
4	Request To Send	RTS
5	Clear To Send	CTS
6	Data Set Ready	DSR
7	Signal Ground	SG
8	Carrier Detect	CD
9	Test Voltage	+V
15	Transmit Clock	TC
17	Receive Clock	RC
24	DTE Transmitter Signal Element Timing	

V.35 34-PIN CONNECTOR



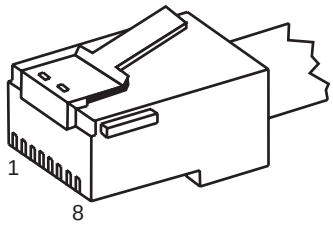
DESCRIPTION

This connector ties the MultiDSU56K to the DTE. The V.35 connector has the following pinout configuration.

PIN IDENTIFICATION

Pin	Description
A	Chassis Ground
B	Signal Ground
C	Request To Send
D	Clear To Send
E	Data Set Ready
F	Receive Line Signal Detect
H	Data Terminal Ready
P	Transmitted Data (A)
S	Transmitted Data (B)
R	Received Data (A)
T	Received Data (B)
Y	Transmit Clock (A)
AA	Transmit Clock (B)
V	Receive Clock (A)
X	Receive Clock (B)
U	External Transmit Clock (A)
W	External Transmit Clock (B)

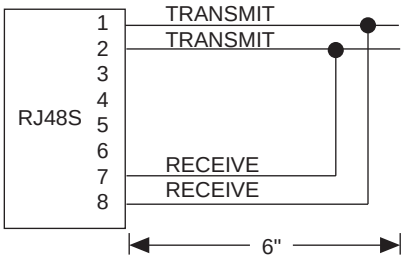
LOOPBACK CABLE
(MTS P/N 45640100)



DESCRIPTION

This cable lets you test the MultiDSU56K when a second DSU is not available. It tests the DSU by having the DSU generate a signal, then the cable "loops" the signal back to the DSU for comparison to the original signal sent. You can order this cable (#45640100) from Multi-Tech, or build one using the instructions below. Refer to Chapter 4 for test procedures.

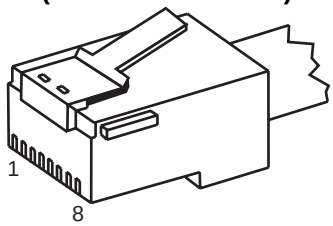
SCHEMATIC



BUILD INSTRUCTIONS

1. Strip cable insulation 3/4"
2. Cut wires 3, 4, 5, 6 off.
3. Strip wires 1, 2, 7, 8 1/4"
4. Solder wires 1 and 8 together.
5. Solder wires 2 and 7 together.
6. Cover solder connections with 1" of shrink tube.

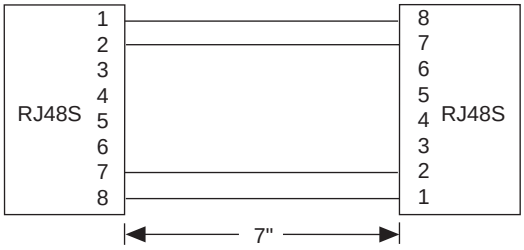
BACK-TO-BACK CABLE
(MTS P/N 45050000)



DESCRIPTION

This cable lets you test a suspect DSU by connecting it to a known good DSU. It tests the suspect DSU by connecting its Transmit signal to the good DSUs Receive circuits. You can order it from Multi-Tech (# 45050000), or build one using the instructions below. Refer to Chapter 4 for test procedures.

SCHEMATIC



BUILD INSTRUCTIONS

1. Strip cable installation 3/4".
2. Strip wires 1,2,7 and 8 on one end of cable and 8,7,2 and 1 on other end 1/4".
3. Cut unstripped wires off.
4. Solder wire 1 on one connector to 8 on the other.
5. Solder wire 2 on one connector to 7 on the other.
6. Solder wire 7 on one connector to 2 on the other.
7. Solder wire 8 on one connector to 1 on the other.
8. Cover solder connections with 1" of shrink tube.

Glossary

This section defines several of the terms used in this manual. For an overview of DSU basics, refer to section 1.4 of this manual.

A

ALBO (Automatic Line Build Out) — part of the "equalizer" circuitry used to compensate for various gauges and alterations of local loops.

Anti-Streaming — an option that prevents a streaming (jammed) DTE from affecting other devices on a multi-point network.

asynchronous communications — communications between computer devices at irregular intervals. To do so, the device adds start and stop bits to each character it sends.

B

BERT (bit error rate tester) — the type of testing used to verify the operating parameters of a data communications line.

bps (bits per second) — unit of measure for data transmission.

C

Central Office (CO) — the telephone company site where switching equipment is located (as opposed to customer premises).

channel — the digital path on a cable on which data is transmitted. A logical way to look at the path data travels when sent between
locations.

circuit assurance — an optional conditioning of the CTS signal.

Clear To Send (CTS) — an interface signal that indicates whether the modem or DSU is ready to accept a data transmission from the DTE.

CO (Central Office) — facility where communications common carriers terminate customer lines and locate line interconnection equipment.

clocking — a synchronous device circuit that sends signals at a precise frequency corresponding to the bit rate of that device.

control station — the station on a DDS multipoint circuit that is nearest the host system and transmits data to each remote station and receives a single serial bit stream from the remote stations via the MJU.

crossover cable — a cable with a conductor that runs the length of the cable, but connects to a different pin number at each end (connects pins 2103 and 3 to 2 from DTE to DSU/CSU).

CSU (Channel Service Unit) — a device used to terminate a digital circuit (such as DDS or T1) at the customer site. Used in combination with a "DSU".

D

Data Communications Equipment (DCE) — equipment that provides the function to establish, maintain and terminate a connection. Additionally, provides the signal conversion required for communications between DTE and data circuit or telephone line. See also "DTE".

DDS (Dataphone Digital Service) — AT&Ts private-line end-to-end digital service, with data rates (typically) at 2400, 4800, 9600, 19200, and 56000 bps. Now an AT&T "Accunet" family offering. The DDS is a synchronous network that uses the ABATS test system, which requires little manual intervention.

default — the factory set position or value that a device assumes at startup. An alterable parameter.

digital loopback — a type of diagnostic test where the transmitted signal is returned to the sending device after passing through a data communications link; the returned signal is then compared to the transmitted signal.

DSR (data set ready) — an RS232 signal that indicates the DCE and line are ready to receive data.

DSU (Data Service Unit) — a device used to interface a user's DSU to a digital circuit (such as DDS or Ti). Used in combination with a "CSU'.

Data Terminal Equipment (DTE) —a device that provides output data in the form of digital signals. See also "DCE".

E

elastic store — an option that causes the DSU to allow for timing phase drifts in non-DDS applications.

F

four-wire circuit — two twisted-pair circuits with each pair transmitting signals in the opposite direction.

J

jumper — a wire that connects two or more pins; a configurable component on a printed circuit board.

L

leased line — a permanent communication line between a computer and a terminal providing private, continuous access to the connection by a subscriber for a fixed fee.

LED (Light Emitting Diode) — a light source that emits visible light.

local loopback — a type of diagnostic test where the transmitted signal is returned to the sending device after passing through a local communications loop; the returned signal is then compared to the transmitted signal.

M

master station — see "control station".

MJU (Multipoint Junction Unit) — a digital data bridge, located at telco office, for the DDS network. Used to combine remote station's bit streams into one serial bit stream for transmission to the control station.

Multi-drop — see "multipoint".

multipoint — a single line or circuit that connects several stations supporting terminals located in different areas. Usually requires some type of pooling method. Contrast "point-to-point".

multipoint circuit — a type of DDS network that includes one control station, attached remote stations, and all channel, MJU and digital access lines for station interconnection.

0

OCU (Office Channel unit) — a DSUICSU located in the telco central office.

OOS (Out Of Service) — a condition that occurs when a digital service failure is detected by the network.

p

point-to-point — a circuit with two point directly connected, with no intermediate nodes, computers or branched circuits (but possibly switching facilities). A type of connection that links two (and only two) logical entities (e.g., a phone line circuit). Contrast "multipoint".

R

remote station — a device on a multipoint DDS network that communicates with the master station via the OCU. All remote stations on the DDS must operate at the same bit rate. (AKA, "outlying station".)

RJ (Registered Jack) — a connector for use at customer site (e.g., RJ11, RJ45, RJ48).

RTS (Request To Send) — a lead on the terminal interface. Also a communications device handshaking signal; generated by the receiving device in order to condition a remote transmitter to begin data transmission.

S

serial — a type of communications between two devices in which data is transmitted one bit at a time.

subrate — a data transmission rate of less than or equal to 19.2K bps.

synchronous transmission — data communications where the transmitting and receiving devices are synchronized and characters or bits are sent at a fixed rate.

system status — optional conditioning of the DSR signal.

T

test pattern — a diagnostic test for sending ,detecting and checking a pre-defined pattern of bits.

two-wire circuit — A circuit in which one channel (line) is used for communications in both directions. Contrast ‘Iour-wire circuit”.